Acceleration mechanism of the tip of a bat in baseball batting:
“Same-field hitting” vs. “Opposite-field hitting”

Yoshitaka Morishita¹, Toshimasa Yanai²
¹Graduate School of Sport Sciences, Waseda University
²Faculty of Sport Sciences, Waseda University

The purpose of this study was to determine acceleration mechanism of the tip of a bat (the bat-head) for the same-field (SF) hitting & the opposite-field (OF) hitting. Four male collegiate baseball players were asked to perform the so-called free-batting with maximal effort aiming at SF or OF. The motions of the bat and ball were recorded with two high-speed cameras (500 Hz). The inverse dynamics analysis procedure was applied to determine the force-couple system exerted on the bat by the batter’s hands and presented it in a local coordinate system. The contribution of each element of the force-couple system to the bat-head speed was calculated by integrating the bat-head acceleration attributable to the elements. The bat speed was 34.0 ± 1.4 ms⁻¹ for SF hitting and 33.0 ± 1.5 ms⁻¹ for OF hitting. The contribution of the force in the bat-head to the knob was 73 ± 3% for both hitting. Also, the contributions of the couple and the moment of force were 31 ± 6% and 2 ± 7% in SF, and 40 ± 3% and -5 ± 4% in OF, respectively. These results indicate (a) that the bat-head was accelerated mainly by batter’s pulling action of the bat along the long axis toward the knob and (b) that the turning effects contributing to the acceleration of the bat changed by the direction of the batted ball.